

**Table 1** Frequencies of HLA Class I Alleles That are Known to Serve as HIV CTL Restriction Elements in Four Populations

HLA Alleles	Frequencies*			
	African Americans	USA Caucasians	North American Indians	Thais
A2	16.7	28.3	25.5	25.5
A3	8.9	12.2	2.9	1.5
A11	2.3	5.5	1.0	32.5
A24	4.7	9.6	19.6	14.6
A28	10.9	4.5	6.9	0.3
A30	9.5	2.6	2.0	1.1
A31	1.7	2.0	27.5	1.7
A32	1.0	5.1	2.0	0.2
A33	8.1	1.0	1.0	13.6
B7	8.3	10.0	3.9	2.7
B8	3.2	10.0	5.6	0.2
B12 (44)	6.2	10.4	3.9	5.4
B13	0.9	3.0	1.0	9.3
B14	3.0	4.1	2.9	0.4
B17	10.9	4.9	1.0	8.1
B18	3.3	4.9	1.0	2.5
B27	1.6	4.1	2.9	6.0
B35	7.7	8.5	18.6	2.5
B37	0.9	2.2	0.0	1.4
B52	1.1	1.2	2.9	3.1
B53	12.8	0.8	0.0	0.0
B57	4.2	3.9	1.0	5.2
B60	1.3	4.5	2.9	8.3
B62	1.4	5.5	4.9	5.0
Cw3	9.6	12.6	22.4	15
Cw4	21.0	9.8	15.4	6

\*Frequencies for HLA-A and HLA-B alleles are taken from HLA 1991 [21], HLA-C for African Americans and USA Caucasians are taken from Histocompatibility Testing 1984 [19], HLA-C for North American Indians from Williams and McAuley, 1992 [22], and HLA-C for Thais from the Proceedings of the Second Asia and Oceania Histocompatibility Workshop Conference [23].

**Table 2** Proportion of each of the four populations that would be predicted to present peptides to the immune system

Population	HLA Restriction Elements Chosen	HIV Protein	Epitope Location	Epitope
a) African Americans	A2, A3, A11, B35	nef	73-82	QVPLRPMTYK
	A28, B14	gp41	583-592	VERYLKDQQL
	A30, B8	gp41	844-863	RRIRQGLERALL
	B17, B37	nef	117-128	TQGYFPQWQYNT
	Cw4	gp120	576-383	(S) FNCGGEFF
(Proportion of African Americans expected to present these 5 epitopes is 92.3%)				
b) USA Caucasians	A2, A3, A11, B35	nef	73-82	QVPLRPMTYK
	A30, B8	gp41	844-863	RRIRQGLERALL
	B7	gp120	302-312*	RPNNNTRKSI
		nef	126-138*	NYTPGPGVRYPLT
	B12	p24	169-184	IPMFSALSEGATPQDL
(Proportion of USA Caucasians expected to present these 4 epitopes is 90.2%)				
c) North American Indians	A2, A3, A11, B35	nef	73-82	QVPLRPMTYK
	A24	gp41	584-591*	YLKDQQL
		nef	120-144*	YFPDQWQNYTPGPGIRYPLTFGWCYK
	A31	gp41	770-780	RLRDLIIIVTR
(Proportion of North American Indians expected to present these 3 epitopes is 96.4%)				
d) Thais	A2, A3, A11, B35	nef	73-82	QVPLRPMTYK
	A24	gp41	584-591*	YLKDQQL
		nef	120-144*	YFPDQWQNYTPGPGIRYPLTFGWCYK
(Proportion of Thais expected to present these 2 epitopes is 93.6%)				
e) African Americans	A2, A3, A11, B35	nef	73-82	QVPLRPMTYK
USA Caucasians	A28, B14	gp41	583-592	VERYLKDQQL
North American Indians	A30, B8	gp41	844-863	RRIRQGLERALL
Thais	B17, B37	nef	117-128	TQGYFPQWQYNT
	Cw4	gp120	376-383	(S) FNCGGEFF
	B7	gp120	302-312*	RPNNNTRKSI
		nef	126-138*	NYTPGPGVRYPLT
	B12	p24	169-184	IPMFSALSEGATPQDL
	A31	gp41	770-780	RLRDLIIIVTR
	A24	gp41	584-591*	YLKDQQL
		nef	120-144*	YFPDQWQNYTPGPGIRYPLTFGWCYK

(Proportions of African Americans, USA Caucasians, North American Indians, and Thais expected to present these 9 epitopes are 95.4%, 97.5%, 99.4%, and 97.2%, respectively)

\*The criteria upon which choices among peptides should be made are not yet known. It may be important to choose peptides that have been reported to be immunogenic in non-progressors to AIDS or that have been reported to induce immunodominant anti-HIV T-cell responses.

# TABLE 3

Th-CTL Peptide Prototype Vaccine Immunogens for Testing in Either Mice, Rhesus Macaque or Human

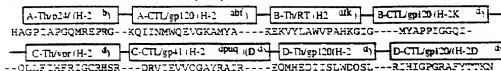
Vaccine number	Name of Peptides	Species in which to be studied	Amino acid sequence	Restricting elements for CTL epitope
1.	Mouse HIV-1 Th-CTL epitopes		Th - CTL	
	A-ThA-CTL	Mouse	HAGP LAPGQNRPRG-KQIINBQEVGKAMYA	H-2 <sup>D<sup>b</sup></sup>
	B-ThB-CTL	Mouse	KEKYLAWPAHKGIG-NYAPFQGGI	H-2 <sup>K<sup>b</sup></sup>
	C-ThC-CTL	Mouse	QLLTHFLRIGRHSR-DRVIEVQGAYRAIR	H-2 <sup>D<sup>b</sup></sup> (D <sup>b</sup> )
	D-ThD-CTL	Mouse	QCNEDTITSLAQSL-RIKUGPGRFYTTIN	H-2 <sup>D<sup>b</sup></sup>
3.	Macaque SIV/HIV-1 Th-CTL epitopes		Th - CTL	
	Th1/CTL SIV Gag	Macaque	ELVYKVKVKEEPLGVAPTRA-CTPYDINQH	Mamu-A*01
	Th2/CTL SIV Pol	Macaque	VST/QCTHGRAPVSTQLL-STPPLVRL	Mamu-A*01
	Th3/CTL HIV-1 Env	Macaque	STSIRGVQKEYAFFYKLDI-YAPFISGGI	Mamu-A*01
5.	Macaque SIV/HIV-1 Th-CTL p11c epitopes various		Th - CTL	
	Th1/CTL SIV Gag	Macaque	ELVYKVKVKEEPLGVAPTRA-CTPYDINQH	Mamu-A*01
	Th2/CTL SIV Gag p11c-Y	Macaque	VST/QCTHGRAPVSTQLL-CTPYDINQH	Mamu-A*01
	Th3/CTL SIV Gag p11c-A	Macaque	STSIRGVQKEYAFFYKLDI-CTPYDANQH	Mamu-A*01
	Th4/CTL SIV Gag p11c-D	Macaque	EYAFYKLDI-CTPYDINQH	Mamu-A*01
	Th5/CTL SIV Gag p11c-K	Macaque	AEQFGNNKTIIFKSGSGDPE-CTPYDKYNQH	Mamu-A*01
6.	Human HIV-1 Th-CTL overlapping epitopes		Th - CTL	
	A-ThA-CTL	Human	KQIINBQEVGKAMYA-KAPSPVZPHF	HLA B*57.B53
	B-ThB-CTL	Human	YKRWITGLNKEVRMYS-NFPLPGEIKYKMI-ELQALCTHSPFSI	HLA B*35.B*27.A*33.B*62.B52
	C-ThC-CTL	Human	DRVIEVQGAYRAIR-VGPPRPQVLPAPMTYK	HLA A1.B*37.B*35.A11.A2.A3.A31
	D-ThD-CTL	Human	ASLANMFNITNMLWY-AYTATQGFPPDWQHTP	HLA B*57.A1.B*35.B*35.B53
8.	Human HIV-1 Th-dominant/subdominant CTL epitopes		Th - CTL	
	A-ThE-CTL	Human	KQIINBQEVGKAMYA-SLNTVATL	HLA A2
	B-ThF-CTL	Human	YKRWITGLNKEVRMYS-KZRLAPGGR	HLA A3
	C-ThG-CTL	Human	DRVIEVQGAYRAIR-KRWITGLNKE	HLA B*27
	D-ThH-CTL	Human	ASLANMFNITNMLWY-GGKKYKRL	HLA B8
	E-ThI-CTL	Human	NREPRGSKAGTIST-SYLLDQQL	HLA B14
10.	Human HIV-1 Th-CTL p17 epitope (A2 Variants)		Th - CTL	
	B-ThE-CTL	Human	YKRWITGLNKEVRMYS-SLNTVATL	HLA A2
	C-ThI-CTL	Human	DRVIEVQGAYRAIR-SLNTVATL	HLA A2
	A-ThK-CTL	Human	KQIINBQEVGKAMYA-SLNTVATL	HLA A2
	D-ThL-CTL	Human	ASLANMFNITNMLWY-SLNTVATL	HLA A2
	E-ThM-CTL	Human	NREPRGSKAGTIST-SLFLAVL	HLA A2
Vaccine number	Name of Peptides	Amino acid sequence	Restricting elements for CTL epitope	
11.	Human HIV-1 Th-CTL overlapping epitopes		Th - CTL	
	A*-ThJ-CTL	KQIINBQVVGKAMYA-QGMVHQATSPRTLNAMWVW		A2, A202.A5, B7, B14, B57, B5701, B5801, B02, Cw3
	A*-ThK-CTL	KQIINBQVVGKAMYA-ATPOLNTYNTVGVGHQAAMKETINERAAEW		A2.A25, A26, B7, B12, B14, B1402, B27, B39, B52, B53, B57, B58, B8101, Cw8, Cw0102
	A*-ThL-CTL	KQIINBQVVGKAMYA-GKPEPFEDYVDRFYKTLRAEQASQEVKRWMT		A2.A202.A5.A24.A2402.A25.A26, A33, B7, B8.B12, B14 B35.B39, B44, B52, B53Bw62, B27, B2705, B57, B5701, B70, B71.Bw62, Cw3, Cw8, Cw0401
	A*-ThM-CTL	KQIINBQVVGKAMYA-KIRLRPGGKKYKLVHIVGSEELRSYNTVATLYCVHRI		A1.A2.A3, A3.I.A03, A11, A23, A24, A20201, A2402, B8, B27, B42, B62, Bw62, Cw4

A\*-ThC4E9V

# Table 4

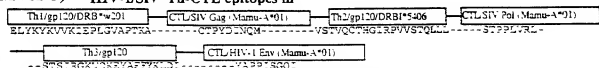
Linear Array of Th-CTL Epitopes To Be Expressed in Modified Vaccinia Ankara

## MVA-1) HIV-1 mouse Th-CTL epitopes in



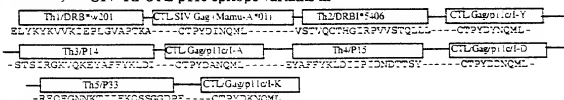
## MVA-2) p55/gag + the same HIV-1 mouse Th-CTL epitopes in MVA-1

## MVA-3) HIV-1/SIV Th-CTL epitopes in

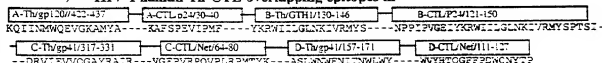


## MVA-4) p55/gag + the same HIV-1/SIV Th-CTL epitopes in MVA-3

## MVA-5) SIV Th-CTL p11c epitope variants in



## MVA-6) HIV-1 human Th-CTL overlapping epitopes in



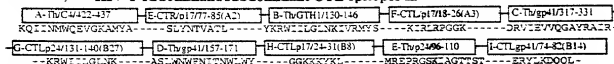
Restricting elements for CTL epitopes:

A-CTL epitopes=HLA B57/B58; B-CTL epitopes=HLA B35/B8/B27/A3/Bw62/B52;

C-CTL epitopes=HLA A11/B7/B8/B35/A11/A2/A3/A31; D-CTL epitopes=HLA B7/B57/A1/B8/B19/B35.

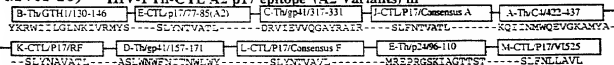
## MVA-7) p55 gag + the same HIV-1 human Th-CTL overlapping epitopes in MVA-6

## MVA-8) HIV-1 Th-dominant/subdominant CTL epitopes in



## MVA-9) p55/gag + the same HIV-1 Th-dominant/subdominant CTL epitopes in MVA-8

## MVA-10) HIV-1 Th-CTL A2 p17 epitope (A2 Variants) in



# Table 5

HIV Polyvalent C4-V3 Peptides Studied in Guinea Pigs, Primates Or In Humans

Peptide	gp120 C4 Region	gp120 V3 Region
C4-V3MN	KQIINMWQEVGKAMYATRPVYNKRRRIHIGPGRAFYTTK	
C4-V3RF	KQIINMWQEVGKAMYATRPNNNTRKSIITKGPGRVIYATG	
C4-V3EV91	KQIINMWQEVGKAMYATRPGNNTRKSIPIGPGRAFIATS	
C4-V3CanOA	KQIINMWQEVGKAMYATRPNNNTRKSIHMGPGKAFYTTG	
C4E9G-V3RF	KQIINMWQGVGKAMYATRPNNNTRKSIITKGPGRVIYATG	
C4E9V-V3RF	KQIINMWQVVGKAMYATRPNNNTRKSIITKGPGRVIYATG	
C4K12E-V3RF	KQIINMWQEVGEAMYATRPNNNTRKSIITKGPGRVIYATG	
Sequences from the Los Alamos Database.		

# TABLE 6

Th-CTL Peptide Prototype Vaccine Immunogens derived from HIV-1 gag

Vaccine number	Name of Peptides Human HIV-1 Th-CTL overlapping epitopes	Amino acid sequence	Restricting elements for CTL epitope
		Th CTL	
6	A-Th/A-CTL	KQIINM <sup>Q</sup> EVGKAMYA-KAFSP <sup>E</sup> VI <sup>M</sup> PM <sup>F</sup>	B57,B58
6	B-Th/B-CTL	YKR <sup>W</sup> ILGLANKIV <sup>M</sup> YS-NPPI <sup>V</sup> GEIYKR <sup>W</sup> ILGLNKIV <sup>M</sup> YSPT <sup>S</sup> I	B35,B8,B27,A33,Bw62,B52
11	A*-Th/J-CTL	KQIINM <sup>Q</sup> VVGKAMYA-GQM <sup>V</sup> HQAIS <sup>P</sup> RTL <sup>N</sup> AW <sup>K</sup> V <sup>V</sup>	A2, A202, A5, B7, B14, B57, B5701, B5801, B02, Cw3
11	A*-Th/K-CTL	KQIINM <sup>Q</sup> VVGKAMYA-ATP <sup>Q</sup> DLN <sup>T</sup> MLN <sup>T</sup> VGGHQA <sup>M</sup> QMLKETINEEAA <sup>E</sup> W	A2, A25, A26, B7, B12, B14, B1402, B27, B39, B52, B53, B57, B58, B8101, Cw8, Cw0102
11	A*-Th/L-CTL	KQIINM <sup>Q</sup> VVGKAMYA-GPKE <sup>F</sup> FRD <sup>V</sup> DR <sup>F</sup> YK <sup>T</sup> LRA <sup>E</sup> QAS <sup>E</sup> VIG <sup>W</sup> MT	A2, A202, A5, A24, A2402, A25, A26, A33, B7, B8, B12, B14, B35, B39, B44, B52, B53Bw62, B27, B2705, B57, B5701, B70, B71, Bw62, Cw3, Cw8, Cw0401
11	A*-Th/M-CTL	KQIINM <sup>Q</sup> VVGKAMYA-KIRL <sup>R</sup> PGGKKY <sup>K</sup> LKHIV <sup>G</sup> SEEL <sup>R</sup> SLY <sup>N</sup> T <sup>V</sup> AT <sup>L</sup> YCV <sup>H</sup> Q <sup>R</sup> I	A1, A2, A3, A31, A03, A11, A23, A24, A2021, A2402, B8, B27, B42, B62, Bw62, Cw4

A\*-Th=C4E9V

## Summary of restricting elements for CTL epitopes in Vaccines A, B, J, K, L and M

A: A1, A2 (02), (01), A3, A3.1, A5, A11, A23, A24 (02), A25, A26 and A33

B: B7, B8, B12, B14 (02), B27 (05), B35, B39, B42, B44, B52, B53, B57 (01), B58 (01) B62 (w62), B70 and B71.

C: Cw3, Cw4, Cw0401 and Cw8.

HIV ThCTL vaccine ABXLM